Maser Man

An early riser by nature, Prof. Charles H. Townes of Columbia University sat on a park bench in Washington, D.C., one spring morning in 1951, staring idly at some azaleas and waiting for a restaurant to open for breakfast. Suddenly, in one of those *coups de foudre* which illuminate the path of scientific discovery, physicist Townes hit upon an idea which opened an entire new field in research, and won him a share in the 1964 Nobel Prize in Physics.

Townes, now provost at the Massachusetts Institute of Technology, was honored last week for conceiving, and later building, the world's first maser, an acronym for microwave amplification by stimulated emission of radiation. Half of the $53,123 prize went to Townes, the other half to two Russians, Prof. Nikolay Basov and Aleksandr Prokhorov, though their first maser work was published two years later. The Nobel Prize committee completed its labors by giving the chemistry prize to an English researcher, Mrs. Dorothy Crowfoot-Hodgkin, 54, who spent eight years working out the structure of penicillin and vitamin B-12. Her award was the first to a woman since France's Irène Joliot-Curie won the chemistry award in 1935.

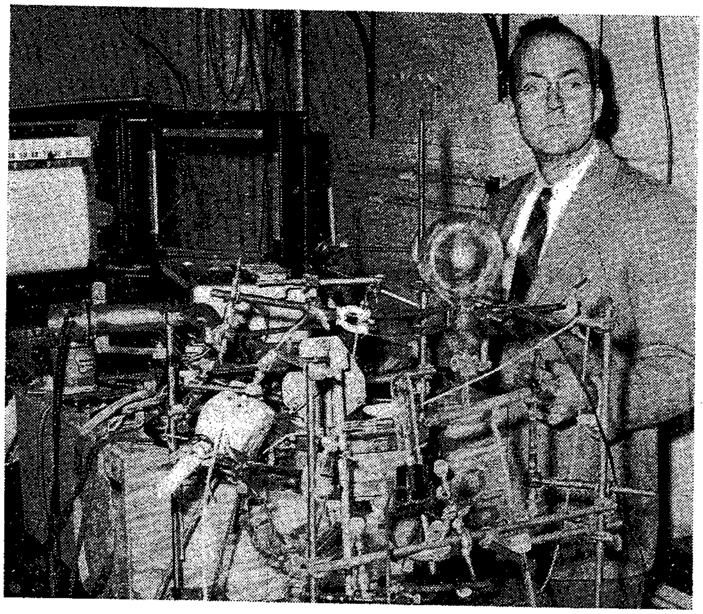
Associated Press

Crowfoot-Hodgkin

Basov

Associated Press

Prokhorov



Townes and early maser (1958) : It began with azaleas

That spring day, Townes had been pondering new ways of using higher frequency microwaves for communications. The reason was simple: the higher the frequency, the more conversations and data can be transmitted. But the technical problem was onerous: electronic amplifiers could not be made small enough to handle the higher frequencies. As the 49-year-old Townes recalled the moment of insight last week, he asked himself: "Why not use molecules and atoms to amplify radio waves?" Not only are they small enough, but when they vibrate they do not emit all the random noises that vacuum tubes and other man-made amplifiers do. From then on, Townes proceeded to think about molecules, atoms, and energies according to the rules laid down by Max Planck and Albert Einstein.

Small Packages: Rule one is Planck's quantum theory: electromagnetic energy comes in bunches, or separate packages, and can be absorbed by atoms one package at a time. Rule two is Einstein's application of quantum theory to radiation energy: if enough assembled atoms or molecules absorb some energy, and more radiations keep pouring down on them, this rain of energy will stimulate the atoms to give off the energy they have already absorbed. Since this energy is emitted at the same frequency as the incoming signal, the practical effect is to amplify the signal. In this way a maser "mases"—incoming radiations are strengthened, or amplified, by the emissions they stimulate.

In 1954 Townes succeeded in operating the first cumbersome maser. It happened that this maser operated at only one frequency, but others were soon built that could be tuned to different frequencies. These quickly revolutionized radio astronomy and communications. Masers now receive and amplify interstellar radio signals that could never before be heard. And masers in antennas which monitor signals from communications satellites such as Telstar amplify what they hear by at least 10,000 times.

Townes also enriched science and the language when he proposed in 1958 that masers could work with the light frequencies that are visible to human